Lava, Fire, and Plants

Wildfires have a dramatic effect on Hawaiian landscapes (D'Antonio et al. 2000). Historically, wildfires were believed to be relatively small and infrequent (more than 700 years apart) in Hawaiian forests despite the presence of natural ignition sources such as lightning and lava flows (LaRosa et al. 2010). In 2002 and 2003, lava-ignited wildfires occurred in the East Rift forests of Hawai'i Volcanoes National Park, and were presumably intensified by drought and nonnative plant species that alter fuel loads and fire behavior.

Although many native species demonstrate some capacity to survive these fires (Ainsworth and Kauffman 2009), overall the fires appeared to encourage the establishment of nonnative plant species. Once established, these invasive species appeared to slow or alter recovery of native forests (Ainsworth and Kauffman 2010). Following the 2002/03 fires, managers and researchers hypothesized that future fires may continue to favor invasive species, possibly resulting in a conversion from native forest to nonnative shrublands similar to the conversions documented in the park's dry ʻōhiʻa woodlands (Vitousek and D'Antonio 1992).

In March 2011, the lava ignited Nāpau wildfire reburned substantial areas of previously burned forest in the East Rift wet forest of the national park and provided an excellent opportunity to examine the effects of repeated fires on native Hawaiian plants and forest birds. The East Rift forest has long been recognized for its rare plants and birds. The area also contains unique assemblages of native lowland wet forest plant species that serve as important seed sources for colonizing new lava flows.

Coincidentally, the Pacific Island Network Inventory and Monitoring Program (I&M) had just completed the initial implementation of the Focal Terrestrial Plant Communities, Established Invasive Plant Species, and Landbirds vital signs monitoring protocols in the East Rift forest in 2010. Specifically, field crews surveyed 18 vegetation community plots, 9 invasive plant species transects, and several bird transects in and near the affected area. Vegetation sampling surveys included unburned forests with ʻōhiʻa canopies and dense hāpuʻu subcanopies. The survey also included forests recovering from the 2002/03 fires with dead ʻōhiʻa canopies, recovering hāpuʻu tree ferns, and abundant invasive grasses.

These monitoring data were intended to provide park managers with information on the current status of the East Rift forests and enable them to detect changes over time with repeated monitoring every five years. The surveys were also designed to provide an important baseline from which to study the effects of events such as wildfires or hurricanes on park forests and their avian inhabitants. The 2011 Nāpau fire burned five newly established vegetation community plots, three invasive plants transects, and sections of three bird transects.

Immediately following the Nāpau fire, I&M and park resource management staff teamed up to assess the severity of the burn. Furthermore, this summer we will resurvey the vegetation plots and transects to document the initial vegetation response to the fire. Unlike previous fires in the East Rift, this time we have pre-fire data. Comparing before-and-after data greatly improves our ability to understand changes within these important forest communities. Further deepening our knowledge of the recovery of this area, these plots will again be resurveyed in four years as part of the standard monitoring cycle.

Inventory and Monitoring biotech assessing the burned forest floor

Unburned | Burned in 2003 | Photo from 2010 | Burned in 2003 and 2011

Current and accurate vegetation data are particularly important for this region because the park is considering measures on how best to preserve these special resources.

—A. Ainsworth,
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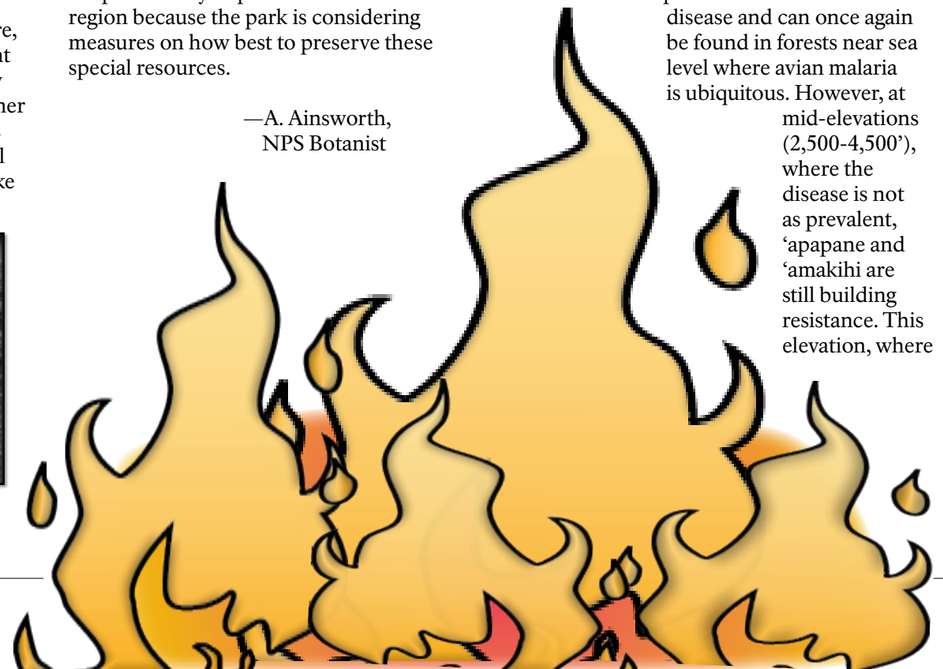

Lava, Fire, and Birds

Rare native forest bird species such as ʻiʻiwi, ʻākepa, and ʻakiapōlāʻau are restricted to higher elevations in Hawaii; where, in the absence of mosquitoes, the birds can avoid the transmission of avian malaria. With the threat of climate change and higher mean temperatures, developing resistance to the parasite may be the key to survival for those species. Populations of ʻapapane and ʻamakihi, over decades of exposure to the parasite, have developed some resistance to the disease and can once again be found in forests near sea level where avian malaria is ubiquitous. However, at mid-elevations (2,500-4,500'), where the disease is not as prevalent, ʻapapane and ʻamakihi are still building resistance. This elevation, where native forest birds are still rebounding, is precisely where the Nāpau wildfire occurred in the East Rift of Hawai'i Volcanoes National Park.

The East Rift is an important transition zone, where birds more resistant to malaria may transfer their valuable genes to more vulnerable upland populations.

The East Rift contains 4,400 hectares of forest near the Nāpau and Makaopuhi craters, as well as part of the very active Puʻu ʻŌʻō vent that stirs just inside the park boundary. Volcanic activity has formed a mosaic of old and young native forests in this very dynamic landscape. The habitat is ideal for many birds which can exploit a variety of habitats for foraging and nesting. The NPS Pacific Island Network Inventory and Monitoring program periodically collects data on the distribution, density, and abundance of these birds along with data on vegetation communities and invasive plant species.

In the spring of 2010, almost one year before the Nāpau fire, the East Rift was surveyed for native and non-native forest birds. Crewmembers counted every bird seen and heard, as well as the distance from the observer to the bird; for an 8-minute period on established stations along transects. The transects are straight and long paths, and cross some of the densest and most isolated forests within the national park.

Bird abundance estimates in 2010 were generally positive for some native bird species. Over 44,000 ʻapapane, 5,000 ʻamakihi, and 2,000 ʻōmaʻo were estimated to be residing in the East Rift. No endangered species were detected, nor were the ʻiʻiwi or ʻelepaio. ʻAmakihi detections were surprisingly low, which may be an effect of malaria and/or the specie's preference for drier habitat. Common non-native species were also found; over 53,000 Japanese white-eyes are estimated to be using the area, and less than 1,000 each of northern cardinals and red-billed leiothrix were detected.

The Nāpau fire, which was started by the volcanic Kamoamoa fissure eruption on March 5, burned almost half of the East Rift forest just as fires did nearly ten years ago. With the removal of forest habitat, we may expect a decline in the occurrence of forest birds in the area. However, many birds returned following previous burns —but will this extreme event of repeated fires cause long-term permanent habitat degradation or loss? The baseline data we collected on the birds in 2010 will provide us necessary information to compare with future bird monitoring data in the area. This will give us an idea of the long-term impacts the fire had on these precious animals.

We can hope that the fire will have only short term impacts on bird habitat and that a native forest can reestablish. ʻŌmaʻo, in particular, are vital for the recovery and diversity of native forests because it is Hawai'i Island's only remaining native seed disperser.

Thankfully, this fire was contained before even more vital habitat was destroyed. There is some comfort that Pele was at the hand of such destruction, but the long-term impact of invasive-plant-fueled wildfires in a changing climate will only be deduced with consistent and regular vegetation and avian monitoring.

—S. Judge, CESU
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